

## CASE STUDIES ON PRAWN CULTURE

Alfredo Lopez

Project Study: Conversion of An Existing Milkfish Pond to Prawn Culture in Negros Occidental

A. Resume of Findings and Conclusions

## Project Study

This is a project study on the conversion of an existing milkfish fishpond to prawn culture in Negros Occidental. The project site, an established milkfish fishpond in Negros Occidental, was found that it could be converted into prawn culture. Existing conversion procedures in other parts of the world would be modified to suit local conditions. The conversion was taken from the economical point of view wherein the capital outlay could be self-financed from the proceeds of the existing fishpond and the capability of the entrepreneur. In spite of opinions on the potential earnings of a prawn pond there has been no clear-cut study of implementing this on a commercial scale within reasonable limits. In the past, the primary crop was milkfish and the secondary crop was shrimp or prawn. This study aims to make the prawn the primary crop and milkfish the secondary crop.

The importance of this study is to determine the productivity in kilograms per hectare of the applicable technology; systems of management; and the defined modifications of technological input for commercial scale production. It also aims to find out the risk and cost of production, in order to define in real terms the profitability of commercial prawn culture.

## Market Study

Most of the data for the market study were obtained from the Bureau of Fisheries and Aquatic Resources Statistics.

The supply study was done by correlating shrimp production in commercial vessels to the three sections of the fishing industry. By using 1963 as a base year, getting fishpond areas in production of 1974 and the fish production of the three sectors from 1963 to 1974, the estimated shrimp production as shown in Table 3.4 was compiled. A factor of about 3.60 percent of the total fish production is the shrimp production of the country. A supply projection was forecast to the year 1982 with two growth rates of 6.21 percent and 8.02 percent. By 1982, it is estimated to about 60,000 M.T.

The per capita intake of shrimps is about two kilograms according to NIST reports while the historical capita intake is 0.76 kgs. By using Dr. Russek's FAO formula and checking the degree of variance with the TFHS formula, the deficit of shrimp production to effective demand is 2,415 M.T. in 1977 to 509,000 M.T. in 1982.

On the basis of price fluctuation of two fish brokers, one in Manila the other in Bacolod, the prawn had an average price of ₱25.00 per kilo while that of bangus was ₱5.00 per kilo for 1976.

Foreign trade on shrimps showed a decline from 1969 to 1974. Japan was the major consignee of shrimp export while the United States had a low record. Exports of shrimps reached 20 percent of the total fish export in 1971 and declined to 7 percent in 1974. One main reason for the decline was poor quality. The BOI set standards in 1973 for shrimp export as shown in Annex A-D.

The marketing strategy was to sell one third of the total produce locally while the rest to be shipped to Manila. The average marketing cost of bangus and prawn is ₱1.63 per kilo.

#### Technical Study

Prawn was discussed primarily in the technical study. The present fishpond set up was remodelled from the economic point of view by combining adjacent areas, making peripheral canals, and installation of two gates in each rearing pond. Major areas of renovation are the maturation ponds and the prawn nursery ponds. The first set up would be for rearing 50,000 bangus and 275,000 prawns per three month cropping period.

Work would commence in early December when the third cropping of bangus is to be harvested. It is divided into three phases which would have a timetable of one year.

The culture process is rearing the fry in nursery ponds, stocking them in the transition pond, and rearing them to marketable size in about three months. Bangus has an average stocking rate of 3,000 pieces per hectare, prawn is 10,000 pieces per hectare.

The prawn fry, supply being the limiting factor of a full scale commercial prawn production, would be augmented by a hatchery. The technology is provided by the Aquaculture Department of SEAFDEC. Total production for bangus would be 33.5 tons and that of prawns 33 tons after the second year when all systems are fully operational.

### Management Study

The project will be funded by the proprietor. It will hire seven (7) personnel to run it. The total labor cost would basically be ₱2,420.00 per month. Commissions would be production-oriented i.e. personnel shall earn ₱0.05 per kilo of bangus and ₱0.50 per kilo of prawns. All personnel shall be sent to SEAFDEC for training on various management programs.

Management of this study is divided into three areas: (1) water, food growth and feeding; (2) fry and nursery handling and (3) harvesting.

Pond recording and data collection should be kept regularly. Various forms of pond recording were taken from the SEAFDEC Leganes Station.

Management skills and knowledge of the technology operations is very important in the hatchery; therefore, job applicants would be limited to those trained in SEAFDEC or working with the SEAFDEC Aquaculture Department.

### Financial Study

The total capitalization cost of the entire project would be ₱407,345.00, divided into four areas: pond system renovation is ₱68,000.00; hatchery system is ₱120,000.00; movable equipment is ₱84,000.00 and working capital requirements is ₱134,500.00.

The fixed cost per hectare is ₱1,400.00 while variable cost is ₱4,140.00 or a total cost of ₱5,540.00 per hectare. Sales would be ₱22,900.00 per hectare during the first year and ₱34,500.00 in the succeeding years of operations.

There are three items which are heavy expenditures: pest and pesticides, and feeds.

Profit for the first year is ₱180,000.00 that of the succeeding year ₱380,000.00. The return on investment for the first year is 21 percent, the second year 41 percent.

Break-even point based on constant production rate is ₱13.20 per kilo of prawn and ₱2.65 per kilo of bangus; break-even point on volume on the assumed price of ₱25.00 per kilo of prawns and at ₱5.00 per kilo of bangus is 430 kilos of prawns and 470 kilos of bangus. The ratio of price differential is 5:1 and 90 percent of production rate.

A sensitivity analysis was done on this ratio with artificial plugging of prices to see break-even production rates.

## Summary and Conclusions

The project could be undertaken inasmuch as the present technology is available. The limiting factor to the success of the proposed hatchery project is the skill and knowledge of the operator and his personnel.

The amount of initial capital outlay needed for the project is quite substantial and, therefore, financing of the project is recommended. Although the rate of return is not as high as envisioned earlier, it is quite average for the industry as a start.

There are some areas of considerations which can be devised to reduce cost so that the whole set up could be easily financed.

It is therefore concluded that the idea of a commercial scale production of prawns is viable and feasible in the country not only for local consumption but also for export.

## B. Introduction

### Objectives of the Study

This study is based on the idea of expanding the prawn industry in the Philippines. Since it is considered one of the luxury species for culinary purposes here and abroad, there exists a big demand-supply gap; hence, it is high-priced and a potential dollar earner for the country. This project is undertaken for several reasons:

1. establish a small scale prawn hatchery thus solving the problem of limited supply of prawn fry,
2. determine the numerical value in terms of kilograms per hectare of applicable technology,
3. find the risks and cost of production, and
4. find out in definite terms the feasibility and profitability of commercial prawn culture.

### Scope and Limitations of the Subject

An existing fishpond located in Barrio Luna, Cadiz City, Negros Occidental whose main culture is milkfish will be redesigned for prawn culture. It is an ideal location since the fishpond is located between the mouth of two rivers with brackishwater whose salinity is between 15 ppt to 25 ppt. The culture technology used will be an adaptation of various technologies of shrimps and prawn culture of the United States, Japan, Taiwan, Philippines and some Southeast Asian countries.

The stocking material will be wild fry during the season and the hatchery fry during the non-breeding season. Costings of the study will be based on the 1976 prices since all materials gathered are within that year.

There is difficulty in acquiring correct data on prawn statistics because the Bureau of Fisheries has no specific item on prawn. Prawn data are included under the general item of "shrimps". Therefore, the market study is correlated with shrimp and fish data which is good only for 1974.

The management study are based on the author's experiences in running a fishpond. Existing labor laws and regulations were the basis of the study.

The financial study was done on the approved accounting procedures and existing Bureau of Internal Revenue laws.

#### Methodology

The marketing study data were compiled from statistics of the Bureau of Fisheries and Department of Natural Resources. Since no specific data were available for prawn, it was correlated with shrimps and fish. A five year projection of supply and demand from the Task Force on Human Settlements formula was taken and compared with Dr. Russek's Food and Agricultural Organization formula.

The prices gathered were from Mr. Eliseo J. Dingcong, a fish broker in Divisoria, Manila and Mr. Samuel Dewara, another fish broker in Banago, Pala-pala, Bacolod City. These were via personal communications.

The technical aspects were gathered mainly from the SEAFDEC Aquaculture Department.

The management side was based on the ten-year experience of the author on pond culture while fringe benefits were based on the various benefits extended by other progressive pond owners. Gathering of listed management programs to be done by technicians were drawn from the ongoing experiments in the SEAFDEC Leganes station and from SEAFDEC prawn cooperators program.

#### C. Technical Study

##### Project Site

The project site is a titled property located in Barrio Luna, Cadiz City, Negros Occidental. It has a total area of 101.94 hectares, 32.43 hectares of which is a fishpond, the rest planted to sugar and coconut. The project site is bounded in the north by Guimaras Strait.

It is between the mouth of two rivers; the Sicaba and Talaba-an rivers. It is fifty-six kilometers from Bacolod City and three kilometers from the main highway. A feeder road goes into the property. Cadiz City is six kilometers away.

The property is provided with electricity by the Victorias Rural Electric System Cooperative (VRESCO). The fishpond has five security lights and the houses of caretakers are likewise provided with lighting facilities.

#### Fishpond Description and Existing Set-up

The fishpond area is under weather condition Type III; rainfall is constant the whole year round with two to three months dry spell from April to June. The average annual rainfall over a twenty-year total is from 90 to 110 inches.

The tide fluctuation in Guimaras Strait ranges from 1.9 to 1.0 meter. The area has two tides fluctuation daily: the neap tide and the spring tide. The fishpond has an average elevation above zero datum of 0.8 meters wherein water could fill the pond with tides of 1.0 meter above and be easily drained. Water quality averages between 18 ppt to 25 ppt which is ideal for growth of prawn.

The fishpond has two main gates of reinforced poured concrete. Each has an opening of 2 meters wide and five meters long. All ponds are interlinked with secondary and tertiary canals.

The fishpond was made and enclosed in 1950 and was completely levelled in 1965. The soil is basically clayloam although at lower level it is sandy.

The present fishpond set up as shown in Table 1 has eight nursery ponds. The total area of the nursery ponds is 2.96 hectares with a stocking rate of 55,000. The rearing ponds have a total area of 26.44 hectares with a total stocking rate of 44,000 for rearing.

Rearing period is three months for a total of three croppings per year. Approximate harvest per crop is 12 tons of bangus at four pieces per kilo.

Table 1  
Present Status of Fishpond and Stocking Rate of Milkfish

<u>POND</u>	<u>DESIGNATION</u>	<u>AREA</u>	<u>STOCKING RATE</u>
73 (1)	Nursery Pond	0.18	50,000 Fry
72 (2)	Nursery Pond	0.42	100,000
67 (3)	Nursery Pond	0.38	100,000
66 (4)	Nursery Pond	0.60	150,000
74 (5)	Nursery Pond	0.49	100,000
71 (6)	Nursery Pond	0.45	100,000
68 (7)	Nursery Pond	0.28	70,000
65 (8)	Nursery Pond	<u>0.16</u> 2.96	<u>50,000</u> 710,000
69 (1)	Transition Pond	0.78	15,000
60-A (2)	Transition Pond	0.96	20,000
79 (3)	Transition Pond	<u>0.98</u> 2.72	<u>20,000</u> 55,000
70 (1)	Rearing Pond	1.47	3,000
63 (2)	Rearing Pond	1.62	3,000
64 (3)	Rearing Pond	1.31	2,500
61 (4)	Rearing Pond	1.47	3,000
62 (5)	Rearing Pond	1.33	3,000
60 (6)	Rearing Pond	1.70	4,000
84 (7)	Rearing Pond	1.23	2,500
75 (8)	Rearing Pond	2.13	4,000
76 (9)	Rearing Pond	1.24	2,500
77 (10)	Rearing Pond	1.63	3,000
78 (11)	Rearing Pond	1.68	3,000
80 (12)	Rearing Pond	3.56	6,000
82 (13)	Rearing Pond	<u>2.47</u> <u>26.44</u>	<u>4,000</u> <u>49,500</u>
		32.12 Ha	814,500

### Description of Planned Set-up

The planned set-up was based from the economic viewpoint. Pond areas would be merged together to obtain the desired effect of a flow-through system. One is the inlet and the other the outlet, thus the need for two gates in each rearing period.

The plan consists of making peripheral canals or trenches five meters wide and seventy five centimeters lower than the general pond bottom. This would serve as refuge of prawns during hot climate and would facilitate pond preparation and harvesting. Thus the plan of constructing peripheral canals would entail big savings. To augment the flow of water of a pump would be used. This would add further to the flexibility of water management.

One of the many recommendations of prawn pond is to have a water level of one meter to 1.8 meters. However, the total excavation of the ponds proves to be uneconomical. Another reason is that with deeper excavation of the pond bottom, ferrous sulphate soil might be encountered. Smooth bottom ponds needed for culture of some fish are not required for shrimp culture.

A recent estimate to excavate a cubic meter of soil is ₱2.50 to ₱5.00 in Negros Occidental. Therefore, to excavate a hectare would entail ₱25,000 to ₱50,000 development cost. The peripheral canal renovation method would be done from a purely economic point of view. The materials excavated from the trenches would be used to strengthen and heighten dikes to be able to withstand the water pressure of a one meter deep pond and securing it from leakages.

Another consideration is that deep ponds using tidal fluctuations would be requiring wide concrete gates. These wooden gates if properly constructed and treated would last from four to six years. All gates would be remodelled to permit installation of three filtering devices to have an above par predation control.

The final set up as shown in Table 2 and Figure 2 would have four bangus nurseries of 1.53 hectares capable of handling 600,000 fry; two prawn nursery ponds of 1.09 hectares with a reservoir of 1.50 hectares; two maturation tanks of 0.34 hectares capable of handling 800 pieces of adult prawn; two bangus transition ponds of 3.23 hectares capable of handling 60,000 fingerlings; one prawn transition pond of 1.24 hectares capable of handling 100,000 prawns and eleven rearing ponds for polyculture of prawns and bangus with a total area of 29.30 hectares capable of rearing 50,000 bangus and 275,000 prawns.



Table 2  
PROPOSED AND FINAL SET UP OF POND WITH THEIR STOCKING RATES

POND	DESIGNATION	AREA	STOCKING RATE		STOCKING RATE	
			BANGUS		PRAWN	
BN <sub>1</sub>	Nursery Pond	0.42		200,000		
BN <sub>2</sub>	Nursery Pond	0.38		100,000		
BN <sub>3</sub>	Nursery Pond	0.28		100,000		
BN <sub>4</sub>	Nursery Pond	<u>0.45</u>	<u>1.53</u>	<u>200,000</u>	<u>600,000</u>	
PN <sub>5</sub>	Nursery Pond	0.60				500,000
PN <sub>2</sub>	Nursery Pond	<u>0.49</u>	<u>1.09</u>		<u>400,000</u>	<u>900,000</u>
M <sub>1</sub>	Maturation Tank	0.18				800
M <sub>2</sub>	Maturation Tank	0.16	0.34			<u>800</u>
BT <sub>1</sub>	Transition Pond	1.23		25,000		
BT <sub>2</sub>	Transition Pond	<u>2.00</u>	<u>3.23</u>	<u>35,000</u>	<u>60,000</u>	
PT	Transition Pond	<u>1.24</u>	<u>1.24</u>			<u>100,000</u> <u>100,00</u>
RP <sub>1</sub>	Rearing Pond	2.25		4,000		20,000
RP <sub>2</sub>	Rearing Pond	2.93		5,000		25,000
RP <sub>3</sub>	Rearing Pond	5.46		10,000		50,000
RP <sub>4</sub>	Rearing Pond	2.13		4,000		20,000
RP <sub>5</sub>	Rearing Pond	2.61		5,000		25,000
RP <sub>6</sub>	Rearing Pond	7.85		12,000		75,000
RP <sub>7</sub>	Rearing Pond	<u>6.07</u>	<u>29.30</u>	<u>10,000</u>	<u>50,000</u>	<u>60,000</u> <u>275,000</u>
			37.11			

## Legend:

BN - Bangus Nursery  
 PN - Prawn Nursery  
 BT - Bangus Transition  
 PT - Prawn Transition  
 RP - Rearing Pond

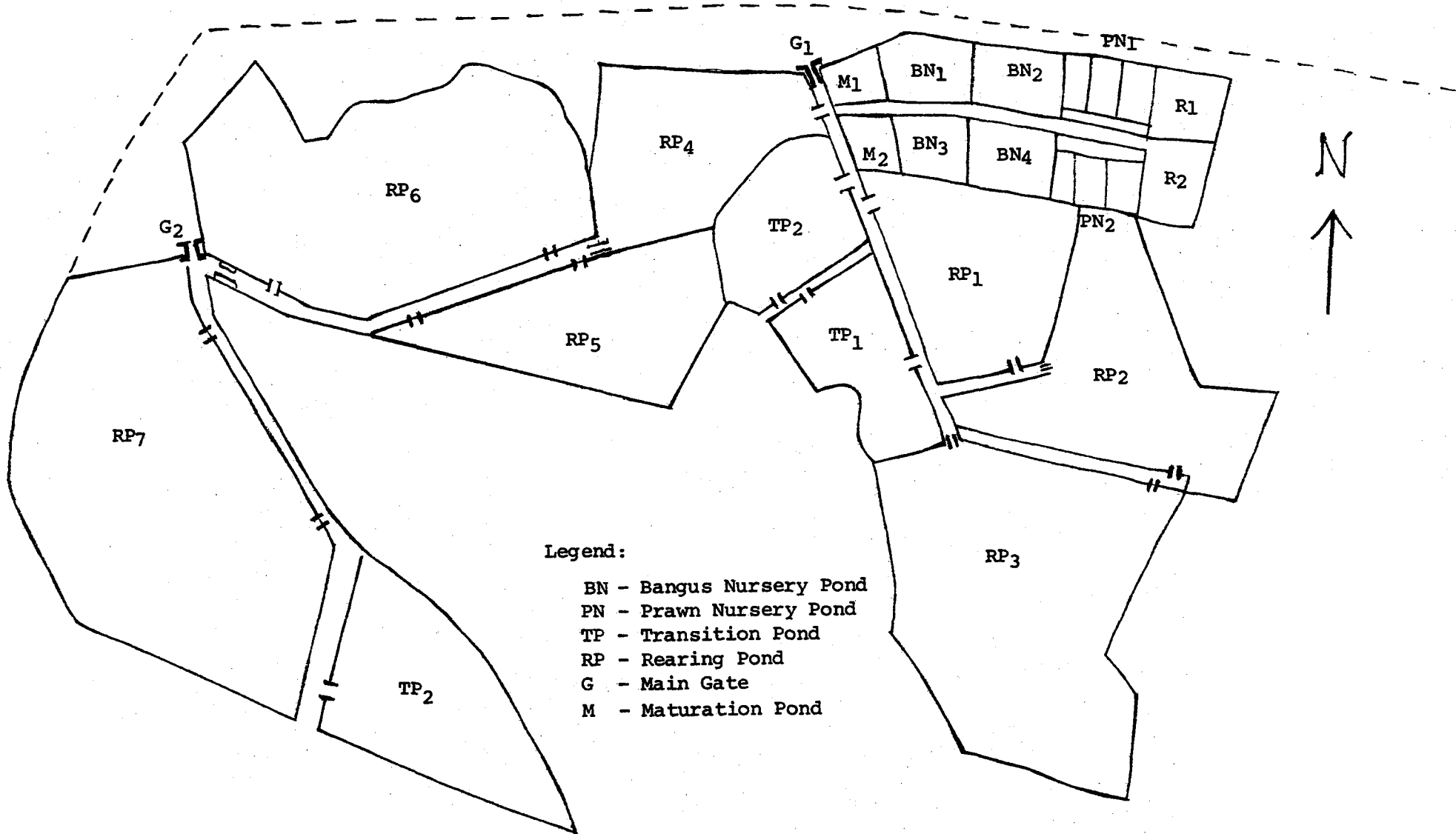


Fig.1 REVISED DESIGN OF PONDS

### Project Plan

As shown in Figure 1 and Table 2, the plan set up and the maturation ponds would read  $M_1$ ,  $M_2$ ; bangus nursery ponds are  $BN_1$ ,  $BN_2$ ,  $BN_3$ ,  $BN_4$ ; prawn nursery ponds are  $PN_1$ ,  $PN_2$ ; prawn transition ponds is PT; rearing ponds for polyculture are  $RP_1$  to  $RP_7$ . The hatcheries would be placed near the nursery ponds.

The maturation tanks would be excavated one meter deep. A bamboo netting would divide each pond into four. Inside this quadrant shall have a fish netting to make the lifting of gravel prawn easy.

The prawn nursery pond shall be divided into three sections with a foot irrigation canal near the secondary canal. A reservoir tank shall be excavated near it. This reservoir will have an installation of sand filters, a pump and piping of 2 1/2 in PVC to the nurseries.

Rearing ponds will have trenches excavated wherein the soil shall be reinforced and heightened the secondary dikes. Each rearing areas have two gates installed. Some of the old gates materials would be used if found usable.

Manual labor shall be used in the maturation tanks, peripheral dikes and installations of gates. The use of an LGP bulldozer for the reservoir tanks and  $BT_2$  as high area would be hired.

A proposed contract rate of ₱2.50 per cubic meter would be paid to manual labor and ₱1.75 per cubic meter for rental of bulldozer. The carpenter caretaker would do all the carpentry work on gates and filters.

### Description of a maturation tank

$M_1$  is 0.18 hectares and  $M_2$  is 0.16 hectares. A total of 3,400 cubic meters would be excavated. The soil shall be placed along the dikes making it two meters wide and one meter high. Excess soil will be placed beside the main gate. Bamboo poles of 2 1/2 meters will be staked one meter apart. A bamboo screen will divide the pond into a quadrant. In each quadrant, a nylon netting of mesh would be spread and tied to the bamboo poles. Two hundred mature prawns would be placed in each quadrant with a sex rate of 3 males to 2 females. A total of 800 mature prawns would be the maximum capacity of each maturation pond.

### Description of a prawn nursery pond

Prawn nursery pond (PN<sub>1</sub>) is 0.60 hectares and PN<sub>2</sub> is 0.49 hectares. The ponds will be divided into three equal parts of longitudinal sections. A foot canal would be constructed near the secondary canal. The pond would have a water depth of 40 to 50 centimeters. A reservoir of 0.78 hectares will be bulldozed; it would generally be higher by 1/2 meter than the bottom of the nursery pond. An electric water pump of 2-inch diameter with a rated capacity of 500 gpm shall be installed. Three sand filters would be installed in the reservoir, one for the inlet the other two for the outlets. A piping system of 2 1/2 PVC perforated at the stand pipe end would be installed. A drainage collector pit made of wood would be placed at the foot canal. This pit is generally 10-20 centimeters lower than the general pond bottom connected lengthwise to a drainage canal.

### Description of transition and rearing ponds

In each transition pond, BT<sub>1</sub>; BT<sub>2</sub>; PT<sub>1</sub>; and rearing ponds RP<sub>1</sub> to RP<sub>7</sub>, peripheral canals or trenches of five meters wide and 75 cm deep would be excavated. This would equal to 3.75 cubic meters of excavated soil per linear meter. It would be sufficient to fill the old dike with 1 1/2 meters of earth sideways and 1 1/2 meters from pond water bottom in height with a crown of 1 1/2 meter. This will secure it from major leakages and strengthen it to withstand a one meter high pond water.

A wooden gate would have the following features: it is 3 meters long and 1 meter wide. It has anti-seep boards on the sides and bottom. It has a brace to withstand all soil pressure. It has sets of board enclosures and three sets of screen attachments from coarse to fine and to the final bag nets. It would utilize scrap rubber on the board enclosures to make it water tight. Lastly, piling of bamboo poles at the bottom to prevent it from settling.

Each pond would have two gates, one for the inlet and the other for the outlet. The decision to use wooden gates instead of concrete ones are advantageous for two reasons; it is easily removed in case its placement is erroneous and the capital cost is lesser.

### Description of a hatchery

The prawn hatchery is situated near the nursery ponds. It will be a modified Galveston and SEAFDEC's Platon types. It will have two wooden 2-ton conical larvae rearing tanks and twenty-three one-ton tanks made of marine plywood, of which thirteen would be used for Chaetoceros sp. production (Figure 2)

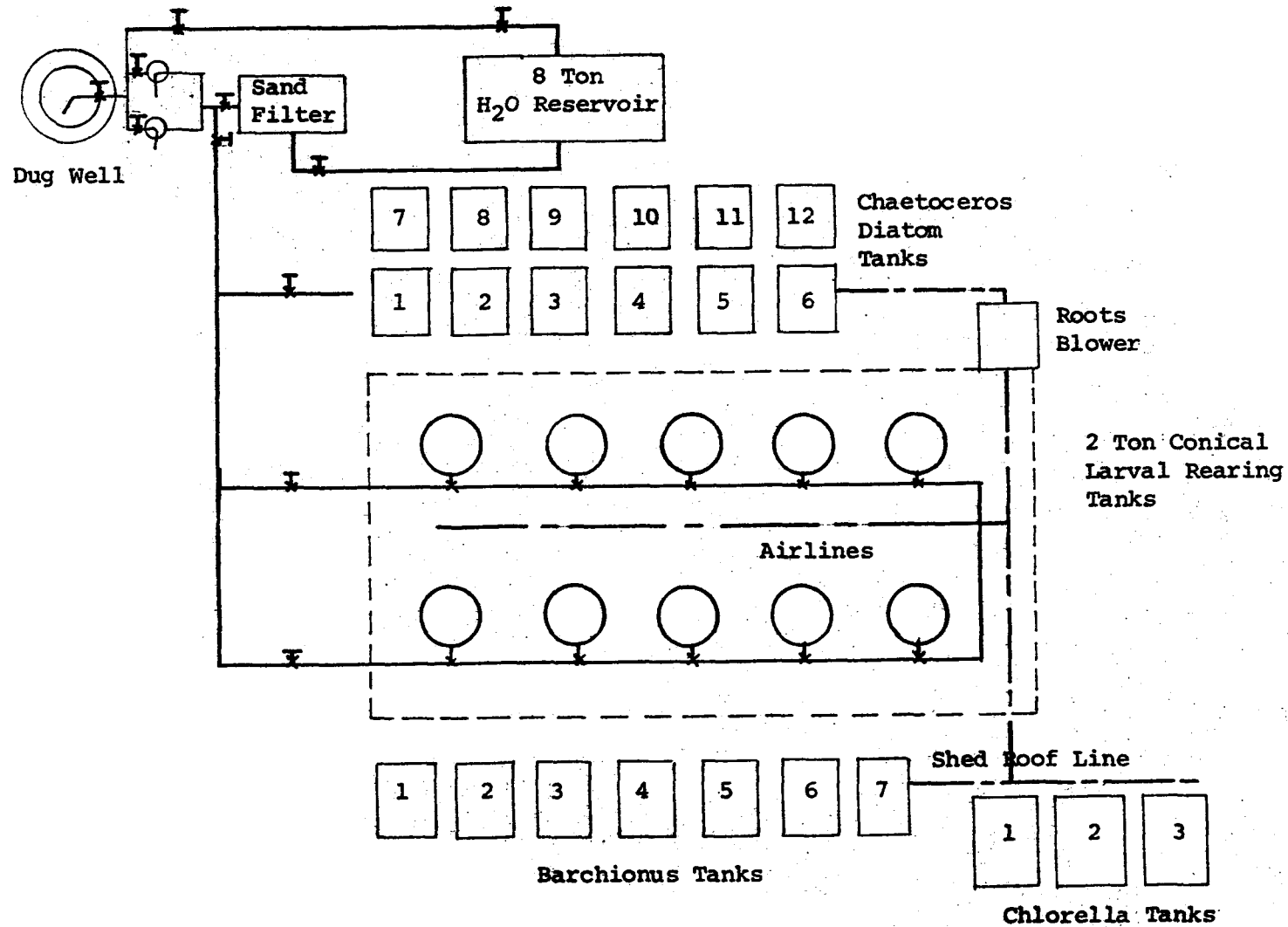


Fig. 2 PROPOSED HATCHERY LAY-OUT

Table 3  
Timetable of Cost and Development

	<u>Man/Days Required<sup>L1</sup></u>	<u>Tractor Hours</u>	<u>Cost<sup>L3</sup></u>
<u>PHASE I</u>			
1. Maturation Pond <sub>1</sub>	15		₦ 5,000
2. Maturation Pond <sub>2</sub>	15		5,000
3. Prawn Nursery <sub>1</sub>	20		7,500
4. Prawn Nursery <sub>2</sub>	20		7,500
5. Reservoir	5	3	2,000
<u>PHASE II</u>			
6. Transition Pond <sub>1</sub>	7	10	1,250
7. Transition Pond <sub>2</sub>	7		1,250
8. Prawn Transition <sub>1</sub>	7		1,250
9. Rearing Pond <sub>1</sub>	15		3,500
10. Rearing Pond <sub>2</sub>	15		4,180
11. Rearing Pond <sub>3</sub>	30		6,710
12. Rearing Pond <sub>4</sub>	15		3,380
13. Rearing Pond <sub>5</sub>	15		3,860
14. Rearing Pond <sub>6</sub>	30		9,100
15. Rearing Pond <sub>7</sub>	20		7,320
<u>PHASE III</u>			
16. Hatchery tanks & Buildings <sup>L2</sup>	90	3	120,000
	<u>326 Days</u>	<u>16</u>	<u>₦188,800</u>

<sup>L1</sup> Based on the assumption that 20 men will work continuously for 8 hours and hiring of one D-4D LgP Tractor bulldozer.

<sup>L2</sup> Four carpenters at work.

<sup>L3</sup> Figures are rounded.

Its water system would be supplied from a dugwell reinforced with concrete culverts seven meters deep. An electric motor of one horsepower will pump the water to an elevated sand filter and drained to an eight-ton water reservoir. Common salt would be used to adjust salinity during rainy season. Other equipment are ten (10) 300-liter tanks for spawning and various equipment for diatom concentrations; filter devices and pails for transport of fry to nursery ponds. A roots blower of 1.5 KVA will supply the air in the hatchery tanks. This would be a duplication of an electric pump and roots blower for standby purposes during down time or repair of the duplicate equipment.

#### Timetable of cost and development

The work shall be divided into three phases of study as shown in Table 3. They are the transition and rearing ponds, the maturation and nursery ponds and the last would be the hatchery. This way, the management of the work will be smooth and will not overlap. The rearing ponds will be done one at a time so that production of bangus would not hamper in any way with the renovation. A detailed flow diagram of work phase is seen in Figure 3 in which it is divided into three phases, each number on top represents 15 days. The reference below the bar lines annotates the work area while the numeral above shows the approximate number of days allotted for the job.

#### Start-up and completion of work

The best time to implement this renovation will be in the third cropping of bangus, between November and December when the nursery ponds are not in use. This would then be operational in time during the next bangus fry season which is in March.

The maturation ponds will be the first to be done so that when the December crop of prawns are in, selected big size prawns could be stocked as potential spawners. The prawn nursery and reservoir would be simultaneously constructed as well as the ground work for the hatchery to be started by this time, i. e. buildings, sheds, and water supply. Equipment will be purchased during this period and properly installed so that the last 30 days will be a test run and conditioning of tanks.

#### Culture process

The culture process would be by batch method wherein the prawn fry is grown in the nursery pond, transferred to a transition pond and finally reared to harvestable sizes in the rearing ponds. This is a continuous process. Pond preparation and food growing would follow soon after the pond has been harvested or transferred to another pond. Once the system has been in full operation, harvesting of prawns could be achieved in four months, one month for pond preparation and three months rearing for a total of three crops per annum.

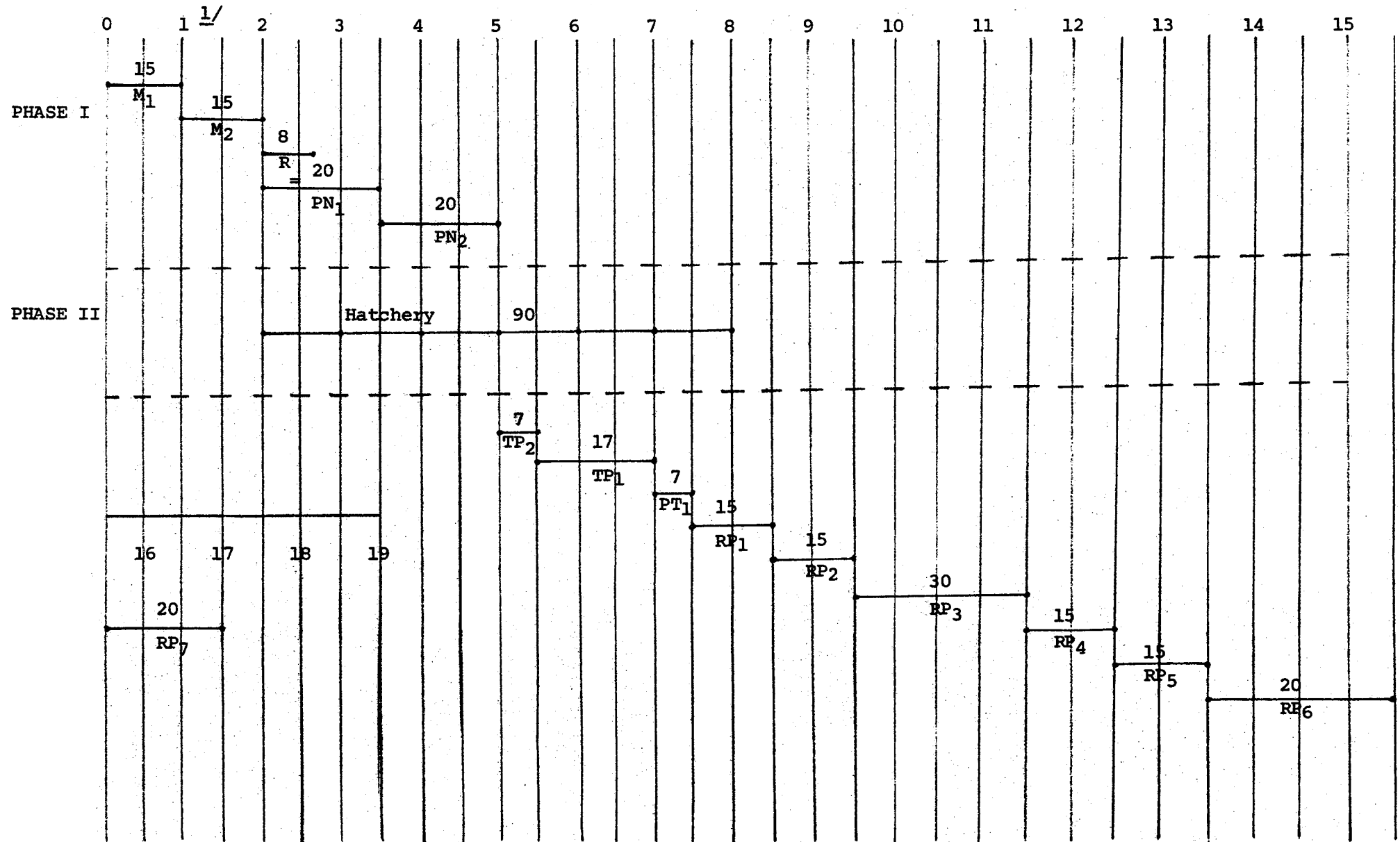


Fig. 3 WORK FLOW DIAGRAM



Table 4 shows the comparative stocking rates and mortalities of bangus and prawns. The survival indices are derived from using the denominator as the initial stock of fry to the nursery.

Table 4  
RATES AND SURVIVAL INDICES

	<u>Prawn</u> <u>Stocking</u> <u>Rate</u>	<u>Mortality</u> <u>Rate %</u>	<u>Survival</u> <u>Indices %</u>	<u>Bangus</u> <u>Stocking</u> <u>Rate</u>	<u>Mortality</u> <u>Rate %</u>	<u>Survival</u> <u>Indices %</u>
Hatchery	50,000 <sup>L<sub>1</sub></sup>	70				
Nursery	1,000,000	50	50	200,000	30	70
Transition	100,000	30	35	25,000	10	63
Rearing	10,000	20	29	2,000	5	59

L<sub>1</sub> Per ton, Nauplius

L<sub>2</sub> Survival indices one for nursery to harvest  $S_n = S_{n+1} (1-M.R.)$

The formula used for the survival indices is  $S_n = S_1 (1 - M_1 R_1)$ . This will indicate a true survival picture of the entire cropping period and individual stages of prawns.

#### Hatchery process

Gravid spawners of stage four can be collected from the maturation pond twice a month to coincide with lunar cycle during the full moon and the new moon phases. It seems that the eggs of these gravid spawners during these phases of the moon have high incidence of good survival rates. Although this statement is non-conclusive, it does support experience.

These spawners are placed in spawning tanks of 300 liters individually, and will hatch within twelve (12) hours. Usually it spawns around 12 midnight to 3:00 a.m. The spawners are then removed in the morning while the eggs are collected and washed of debris. Eggs are collected with platform nets.

The eggs are then placed into a 300-liter hatchery tank with 28 percent seawater; when aerated mildly, they are hatched into nauplii within 12 to 16 hours. These nauplii are counted by the volume of one liter. Around ten samples would be ideal to get a good ratio number.

These nauplii are transferred to the conical hatching tank of 2 tons. Around 50,000 nauplii per ton are placed. In 15 to 18 days, these nauplii have grown to postlarvae stage and it is time to transfer to the nursery ponds.

#### Nursery process

The postlarvae (P<sub>5</sub>) are harvested from the hatchery tanks and acclimatized to the nursery pond water. It is acclimatized only to thermic and saline parameters. The pond has been prepared thirty (30) days beforehand to have a good growth of blue green algae. All the water that goes into the nursery passes two sand filters. At the inlet, water is pumped to a sand filter while at the outlet, water is fed gravitationally to another sand filter (see Figure 4). The outlet sand filter is connected to a 2 1/2 feet diameter PVC piping. This piping runs through one side of the pond and water is controlled through a PVC stand pipe. This stand pipe has holes drilled at the uppermost water level of the reservoir tank to let water flow in when the stand pipe is pushed sideways. The collecting pit serves both as an outlet of water for the nursery pond and as catching pit for the harvest of juveniles. This collecting pit has a sand filter installed to prevent predators from swimming into the area. This is connected lengthwise to a drainage canal of one meter wide and 20 centimeters below nursery general bottom. Water exchange rate daily is between 20 to 30 percent of total water volume. Water depth is maintained at 50 cm to 60 cm.

The prawns are twice fed daily with two equal portions of 5 percent of their body weight. Feeding is done between 8:00 to 10:00 a.m. and 5:00 to 7:00 p.m. feeds are a mixture of ground fishmeal, ground shrimps heads, corn bran, and sorghum bran.

#### Rearing process

The post larvae are stocked in prepared ponds ahead of bangus fingerlings. They are stocked at 10,000 fingerlings per hectare. These ponds have been prepared with lablab growth thirty (30) days before stocking.

Water at stocking time is between 30 to 35 cm and gradually increased every spring tide by 10 centimeters to the desired depth of one meter. Water exchange rate should be maintained between 10 to 15 percent water volume daily. Salinity at rearing period must be maintained between 14 to 25 ppt. This should be accomplished during the dry season from February to May by means of pumping river water at low tides.

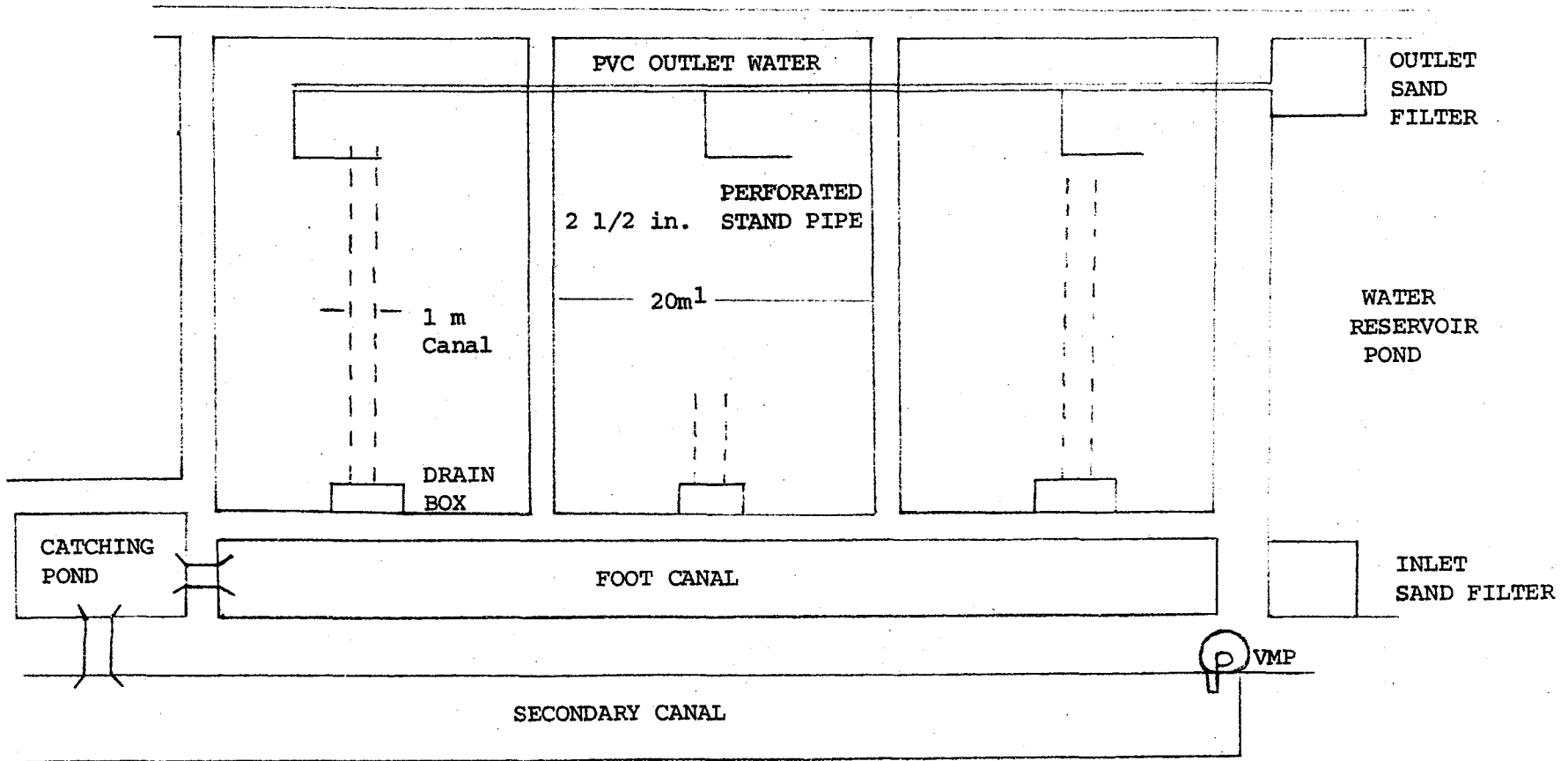


Fig. 4 NURSERY PRAWN POND

Management

## Single Proprietorship

This project will be a single proprietorship where the owner will finance the project from his own funds.

## Labor

The area covered is thirty-six hectares since the optimum capacity of one man is only ten hectares. The project personnel requirement is one overseer for the whole project, four caretakers for bangus and prawns pond supervision, and two caretakers-technicians for the hatchery and the nursery ponds, or a total of seven.

Each personnel is provided with a house measuring 14' x 18' for themselves and their families, complete with housing facilities such as free lighting which is supplied by VRESCO as well as free medical care and hospitalization.

The overseer and the potential hatchery caretakers should have trained in prawn culture in the Prawn Cooperator's Program of SEAFDEC in Tigbauan, Iloilo. At present, there are four caretakers in the existing milkfish fishpond. The four caretakers will be assigned to the rearing ponds. While the two additional personnel will be hired for the nursery and the hatchery operations, all of them will be under the same supervision.

## LIST OF PERSONNEL

<u>Designation</u>	<u>Sex</u>	<u>Status</u>	<u>Basic Salaries</u>	<u>Living Allowance</u>	<u>Educ.</u>	<u>Prawn Seminar</u>
Overseer	M	M	₱350.00/mo	₱50.00/mo	H.S.	SEAFDEC
Nursery Caretaker	M	M	300.00	50.00	Gr. 4	SEAFDEC
Hatchery Technician	M or F	M or F	300.00	50.00	H.S.	SEAFDEC
Pond Care-taker 1	M	M	280.00	50.00	Gr. 4	SEAFDEC
Pond Care-taker 2	M	M	280.00	50.00	Gr. 3	SEAFDEC
Pond Care-taker 3	M	M	280.00	50.00	Gr. 5	SEAFDEC
Pond Care-taker 4	M	M	<u>280.00</u>	<u>50.00</u>	-	-
			<u>₱2,070.00</u>	<u>₱350.00</u>		

The commission of the caretakers is ₱0.05 per kilo of milkfish produced and ₱0.50 per kilo produced of shrimps. This is divided equally among the personnel. The same benefit will be extended to prawn caretakers.

#### Management and Supervision

Since Penaeus monodon is an omnivore, it requires more energy to produce with maximum results. Therefore, skilled personnel is required to be on look out all the time. Additional training of personnel is necessary in management of prawn. Prawn is delicate and raising it requires technical knowhow on the part of technicians. The technicians will be sent to SEAFDEC for the proper training on prawn management.

#### Methods of Management

The methods of management are divided into three main items: water management, food growth, and feeding. Other minor items are procedures in counting of fry and stock transfer of bangus and prawn fry and juveniles.

#### Water management

Water has many physical qualities some of which are directly relevant to aquaculture. The four basic relevant properties are temperature, salinity, dissolved oxygen, and pH. Some of these properties are interrelated.

Temperature of water is governed by solar radiation, the weather and the wind. The higher the temperature, the less dissolved oxygen a unit of water can hold. Like temperature, the higher the salinity, the less dissolved oxygen a water can hold. Good water management is a key to a successful fishpond.

#### Nursery and Transition Ponds

The depth of water is maintained at 50 to 60 cm above the general bottom so therefore the average depth on the trenches would be 1.0 meter. At stocking time, water level should be at 25 to 30 cm. Temperature and salinities are measured during stocking time. A difference of 5°C gradient and 50 ppt above would induce stresses. Gradually increase water by 10 cm every incoming tide until the desired level is achieved. Water replenishment is done every spring tide and this should average 5 days, that is, there are three (3) draining days and two (2) filling days. Drain 10 cm only at a time; draining should be done only at the outlet gate. Replenish 15 cm at the inlet gate. Five (5) cm is a factor due to solar and wind evaporation of water. If shrimps are seen swimming above the surface during

daylight, it is a sign of stress or starvation or low dissolved oxygen levels and high water temperature. Replenish water immediately. If tides are not available, use the portaflow pump. Let the water flow into the inlet gate while draining a smaller amount at the outlet.

After heavy rains, whereupon there would be a salinity and temperature change, drain the fresh water by overflow at the outer gate and replenish water by tide or pump at the inlet gate.

#### Rearing Pond

Generally, this is similar with the nursery and transition ponds; the only difference is that water is 1.0 meter on the general bottom and 1.3 meters at the trenches.

With the plankton method, general replenishment of water is done every 12 to 14 days to coincide with the moving period of last fertilization. If shrimp stress is noticeable, circulation of water must be resorted to. Place the portaflow pump inside to circulate the water. If stress persists, drain one third ( $1/3$ ) of the water at the outlet gate while simultaneously replenish water at the inlet.

During the culture period, a daily check of dikes and gates should be done. Also, before draining for replenishment, the screen must be checked from damages and accumulated debris.

#### Food Growing in Pond

There are two kinds of natural fish food growing in the pond -- lablab and plankton. Lablab is a Tagalog term for a biological association of decomposed phytoplankton and zooplanktons that grow at the bottom of the soil. It is usually greenish-brown in color. The predominant species of lablab is Oscillatoria spp.

Plankton, on the other hand, is a collection of microscopic organisms suspended in water. It is composed of phytoplankton and zooplankton.

There are five major considerations in brackishwater food production: (1) sunlight intensity, (2) temperature, (3) salinity, (4) organic content of soil, and (5) soil type.

#### Procedure in Lablab Production

1. Dry the pond bottom completely and dry it until it cracks.
2. Apply pesticides and molluscicide.

3. Apply organic fertilizer, chicken manure of two tons per hectare. One ton of chicken manure is equivalent to 40 sacks. Organic matter helps in developing algae. Soil containing 6 percent and above of organic matter produces good food growth.
4. Gradually admit water to about 10 cm.
5. After two days, apply two bags of 18-46.
6. Increase the depth of water gradually to about 25 cm.
7. If growth of lablab is few, re-drain the pond and apply again two bags of 18-46 per hectare. This condition is true if excessive rainfall was experienced after the first application.
8. If all five conditions are followed, lablab growth should be in sufficient quantity after 15 days to a maximum of 30 days.
9. To insure a steady growth of lablab with stocked fish, apply 1/4 bag of 18-46 every fifteen days after replenishment of water during the high spring tides. Do this if lablab growth is still insufficient after stocking.

If the lablab growth is still insufficient to sustain the growing fish until harvest time as in wont to be experienced in prawn-bangus production, the plankton method will have to be adopted. A lablab to plankton method would be economical due to less usage of inorganic fertilizer.

#### Procedure in Plankton Growing

Apply fertilizers on platforms, about 4 platforms per hectare or one on every corner, of 2 bags 18-46 at a rate of 20 kgs per hectare for two weeks to maintain water visibility of 20 to 30 cm. A Secchi dish would be employed to regulate plankton growth so it would not reach a danger level of 15 below.

#### Feeding Management

There are three feeding management procedures, one each for the nursery pond, the transition pond and the rearing pond. Although the recommended feeding rate of penaeid species as experimented in Australia was 3 percent of body weight, the 5 percent body weight is taken into consideration due to some species eating some of the feeds. Another consideration was that the cost of feeds as computed in the financial study was ₱1.10 or ₱3.30 per kilo to produce a kilo of prawn or it is approximately 13 percent of its wholesale price.

### Feeding in Nursery Pond

The nursery pond would accommodate roughly 100,000 fry per hectare. The average weight of the postlarvae would be about 500 mg and are expected to grow to about 5 grams a piece in two months' time. During the cycle, feeding will be about 5 percent of their body weight daily. The main constituent would be trash fish mostly tilapia. The tilapia fishmeal would be accumulated from previous harvest; cooked and sun-dried. Tilapia fishmeal would be placed in feeding rings. These are plastic hoses of one-inch diameter formed into loops by inserting the two ends together. This would prevent the feed from drifting to the different sections of the pond. The initial amount of feed would be one kilo daily; gradually increase its quantity to a maximum of 5 kilos daily taking into account the mortalities. There shall be a random sampling to be taken every two weeks to determine the average weight. If the feed under the feeding rings are not consumed, the amount of feed will have to be adjusted to their consumption.

### Feeding in the Transition Pond

The transition pond would accommodate about 60,000 prawns per hectare. The 5-gram juvenile prawn would be expected to grow to 15 to 20 grams after two months. At this stage, the danger of cannibalism is well pronounced. The feed would be trash fish from the deep sea and tilapia, some copra meal, and animal protein. The animal protein would constitute frogs and rats. A feeding of 5 percent of its body weight should be maintained. Since the pond will be induced to plankton growth, this would minimize feeding.

### Feeding in the Rearing Pond

The stocking rate would be about 10,000 fingerlings per hectare. The weight would be from 15-20 grams and they are expected to grow to 75-80 grams in two months. When the prawns have attained a desired weight, it is advisable to harvest them right away, allowing them to grow larger would increase mortality.

The feeding shall be 5 percent of its body weight, the feed stated for the transition pond shall apply likewise. This shall also utilize the feed mix efficiently. The feeding rate per hectare would be 10 kilos at the start to be increased to 25 kilos. This is on the basis that the expected harvesting per hectare would be 500 kilos taking into account the mortalities.

### Fry Management

The fry or seedling is the lifeblood of the bangus and prawn industry. To be assured of fry requirements of bangus or prawns, a method of recruitment must be made. The following are the recommended procedures for fry recruitment:



a. Have three established fry agents whose integrity and honesty are well known;

b. Have them quote the following items before accepting final delivery: the estimated number of fry; price offered; buying point; manner of payment; and where the fry would be inspected.

c. Fry inspection should have these essential considerations: the condition of fry and quality of fry i.e. other species are not mixed.

d. The estimated number of days since the time the fry were caught in the open sea; usually a period of three to seven days in a rough rule of thumb in order to have good survival rate of fry.

#### Procedure in Counting of Fry

There are two basic procedures in counting of fry; the matching method and the percentage method.

##### Matching Method

1. Have about 5 to 6 deep dish plate
2. Count 1,000 fry in one dish (subayan)
3. Match the other dish as with this subayan
4. Change the matched dish every 10 to 20 thousand fry counted. This is done because after a long time, the subayan becomes weaker and will tend to swim near the surface of water thus creating an optical illusion of a lesser number
5. Any discussion regarding the matched set will be treated in this manner: recount the doubtful dish accepted with the condition that if it is over 1,000, the buyer adds another thousand to the accepted number. If it is below 1,000, the seller gives the doubtful dish for free
6. The percentage of error in this manner depends upon the eyes of the one accepting it but an experienced person will incur an error of 1 to 5 per cent only.

##### The Percentage Method

1. Have a prior arrangement with the fry seller that all the fry baskets to be brought to the fishpond are of uniform number
2. Get 10 percent of the number of bags at random

3. Separate these bags from the rest to create a delineation
4. Use the matching method in counting on a per bag basis. Continue with the other 10 percent of the bags
5. If the bags are of the same number, get the total number, divide by the number of bags to find the average number per bag
6. Then multiply with the total number of bags brought by the fry seller to get the total number of fry
7. But, if the number per bag is uneven, do not accept because all the bags are not uniformly placed. Probabilities are that if this is the case, the buyer loses two-thirds everytime. If this is the case, revert to the matching method
8. If the number of bags are of the same number and the accepting person's eyes are experienced, the advantage of this method over matching method is that this is faster.

#### Procedure of Stock Transport

Fry, either bangus or prawn, has to be transported with water. Polyethelene bags measuring 18" x 36" are used for this purpose. The fry are packed in double plastic bags with 10 liters of water; two parts sea water and one part fresh water. They are then placed in "buri" bags or cartons. The plastic bags are then inflated with oxygen. Bangus fry of 7,000 to 10,000 are placed into one bag roughly with 1,000 per liter of water. Prawn fry are from 3,000 to 5,000 per bag. To increase the number of prawn fry per bag, a block of ice must be placed outside the plastic bag just enough to bring temperature down by 5 percent. Bringing down temperature stimulates hibernation so that movement and oxygen levels will be at minimum. About 30,000 fry of P<sub>9</sub> to P<sub>15</sub> could then be accumulated.

The oxygen level is measured by collapsing the bag to water level then placing your hand below 10 inches from the top and fill with oxygen until there is a feel of resistance. The bag is then secured by twisting the top and tying it with two rubber bands. The estimated period of sustainable oxygen level for this method is from 18 hours to 24 hours.

#### Pest and Predators Management Control

To insure good production on prawns and bangus, the growth of food should be maintained by eliminating pests and predators. Draining is one of the best methods of eliminating predators. Dry the pond bottom until it cracks for soil aeration purposes and to have a stable soil for lablab to develop. Drying is usually from seven to nine days.

Application of Gusathion A, an organophosphate insecticide will fully eradicate all fish species. This chemical has no residual effect and deterioration is fast that in seven days, it is safe to stock.

Brestan, Aquatin, Deuter are molluscicide available in the market which are effective in their recommended rates.

Weeds at the sides of the pond are removed. They serve as hiding places of water snakes and compete with food nutrients.

Gates are checked for leakages and immediately repaired. The screens and the bag nets are checked for holes and dried algae growth are removed. Dikes are also checked for leakages. A method of repairing the dike is by digging a puddle trench at the middle of the dike, replacing the soil with new piles of soil, and compacting the new soil.

Upon transfer of the fry to the transition pond, the nursery pond is left vacant in preparation for the next stocking process. The pond bottom is dried for two weeks while the following are being done:

1. repair of wooden gates
2. removal of wrecks and other debris; e.g. coconut leaves, and plastics
3. removal of siltation of the sides and construction of a pathway on which the caretaker could walk around, and
4. repair of catching pond.

#### Harvesting Management

Since the crop is a polyculture of prawns and bangus, each having different harvesting techniques, a procedure of harvesting has to be designed. Bangus, being easier to harvest is harvested first. It is done by draining the pond water and letting the fish swim against the current. Some prawns and shrimps would be included during the draining if harvesting is done in the evening.

Various catching and harvesting paraphernalia should be well prepared and brought to the pond site at least one day before the scheduled harvest.

#### Methods of Packaging

The fish or shrimps are placed into the chilling box to kill them and lower their body temperature. The ratio of ice to fish is two blocks of 300-pound ice for every ton of fish with one more block of ice for transport purposes. They are then transferred into a wooden box measuring 12" high, 16" wide, and 24" long while awaiting to be packed.

Icing and packaging for shipment to Manila are done in a big wooden box measuring 48" in height, 54" in width and 72" in length. The box is built to withstand a content pressure of two (2) tons of ice and a ton of fish or prawns.

The general procedures for fish or prawn icing in a wooden box are as follows:

1. A four-inch bottom layer of crushed ice is evenly laid out and compacted to minimize thawing
2. This is followed by a layer of fish, each laid on its side, belly in one direction and all heads in another direction so that the first layer of ice is covered with fish. Each layer would be about 150 kilos of fish.
3. A 3-inch layer of crushed ice is then laid on the fish so as no fish would be visible. This is then compacted.
4. The placing of alternate layers of ice and fish is continuous until the box is filled. A box could hold seven (7) layers of fish.
5. The last layer on top would be 5" thick and covered with a plastic sheet to protect it from rain or wind. The cover is nailed to make it more secure and safe.

The same procedure of packing applies to prawns. The only difference is that a chicken wire should be placed before each layer of crushed ice to prevent the weight of the upper layer from crushing the prawns.

#### Pond Recording and Data Collection

In every business enterprise, record keeping is a must if a business is to succeed. Recording of data should be kept regularly. Different forms of data collection may be obtained from the SEAFDEC Leganes Station. The informations should be properly entered and the forms kept for ready reference for decision making. The information guides the owner and technicians in evaluating the performance of the project and helps in finding ways to improve results.

### Conclusions and Recommendations

The present technology of prawn culture could readily be adaptable if the following requirements are present: water salinity of 15 to 25 ppt is available and prawn fry or fingerlings can be readily obtained in sufficient quantity. Management techniques are easily taught to operators and technicians, especially with the assistance of SEAFDEC through the different seminars that they offer to those who are interested in the project.

The hatchery system has yet to be proven viable in a small scale program, in this connection it is recommended that various entrepreneurs dedicate themselves to hatchery process while others to prawn fingerlings rearing. This would help solve the problem of non-availability of prawn stocking materials locally.

It is true that the capital needed to invest in this venture is quite big and the rate of return in the first years of operation is not as high as to cover up for the initial capital; however, the profitability is there. The business forecast showed that prawn has a more stable price than bangus.

Thus, it is recommended that a fishpond owner should start prawn culture on a small area to gain experience after which he can cover the whole area to avoid big losses that might arise from miscalculations and inadequate knowledge and experience.